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Making Dashboards Actionable

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Making Dashboards Actionable

In the post-Enron era, dashboards have become the latest tech toy for top execs. But these projects are disconnected from business operations; firms must link dashboards to business processes and actions.

I N T E R V I E W S

Dashboards Have Won Executive Mindshare

Top execs are mandating dashboard projects to deliver visibility into business operations -- and reassurance that their firms are under control. But dashboard projects are tentative and not linked to business processes. And technical and cultural barriers plague those projects.

DASHBOARDS ARE A PRIORITY FOR SOME TOP EXECS

Management dashboards -- and their equivalents, scorecards and cockpits -- are popping up everywhere in the post-Enron business environment. To understand more about these projects, we spoke with owners of dashboard projects from 22 early-adopter $1 billion-plus firms (see Figure 1).[1] Most of those interviewed targeted their dashboard initiatives at the highest levels of management.[2] These C-level sponsors want their dashboards aligned with key corporate goals.

> "Our COO drove the effort to create more local use of knowledge and metrics, sharing his vision from his senior team all the way down to the director level." (Retailer)

> "CXO-level management holds a performance measure meeting with a spider chart in Excel that is difficult to interpret. The dashboard was developed because execs wanted something more visual for these meetings." (Financial services company)

> "The CEO and group section heads set objectives and goals in face-to-face meetings. These are incorporated into our planning systems and measured on a monthly basis." (Energy company)

Cultural Issues Constrain Deployments

Nearly all these dashboard pioneers reported organizational issues ranging from getting agreement on metric definitions to sharing information.

> "Culturally we're in the Stone Age, with some of our users new to computers altogether. So we give them data, reports, and indicators depending on what they want." (Financial services company)

Figure 1 Profile Of Surveyed Companies

Industry	Revenue range	Project scope	Sample metrics
Aerospace and defense	$1B to $5B	Corporate	Orders, sales, profit, cash, inventory turns
Aerospace and defense	$5B to $50B	Functional	System availability, progress on meeting SLAs
Aerospace and defense	$5B to $50B	Divisional	EBIT by business unit, purchasing metrics
Chemicals	$5B to $50B	Divisional	Sales, budget, forecasts, shipments, bookings
Chemicals	$5B to $50B	Divisional	Revenue, productivity, profit, growth, safety issues
Computer software	$1B to $5B	Corporate	Bookings, revenues, costs, lead times
Computer software	$1B to $5B	Corporate	Capital expenditure, P&L, revenue, head count
Energy and utilities	$5B to $50B	Functional	Customer satisfaction, parts in stock, sales
Energy and utilities	$5B to $50B	Corporate	Electric and gas throughput, gas and power prices
Energy and utilities	More than $50B	Divisional	Employee demographics including location, skill set
Financial services	More than $50B	Divisional	Shipments, asset utilization, employee satisfaction
Financial services	$1B to $5B	Corporate	Prospects, sales, pipelines, call volumes
Financial services	$1B to $5B	Corporate	Call volumes, sales
Financial services	$1B to $5B	Functional	Call volumes, wait/talk time, sales, forecasts, lead times
Healthcare	More than $50B	Divisional	Expenses, sales, income, customer satisfaction
Nonprofit	$1B to $5B	Functional	Donations, volunteer demographics
Retail	$5B to $50B	Corporate	Inventory in stock, customer service, sales
Retail	$1B to $5B	Corporate	Warehouse and direct sales, inventory in stock
Retail	$1B to $5B	Corporate	Sales, orders, lost sales, average order value
Technology	More than $50B	Corporate	Pipeline, sales, orders, revenue, expenses
Telecommunications	$5B to $50B	Functional	Project milestones with deadlines
Telecommunications	$5B to $50B	Functional	System outages and run rates

Source: Forrester Research, Inc.

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"People are really sensitive about disseminating and sharing information companywide. So information is provided right before big meetings, and IT publishes it." (Financial services company)

"It was a big cultural issue that everyone gets the same information at the same time. It comes up at 9:00 a.m. in the US, but it might be late in Japan. Management had to learn *not* to call action-takers immediately." (Technology provider)

Firms Want To Update Metric Data Frequently . . .

Although firms admitted that multiple ERP and data sources represented a challenge, 13 firms reported updating dashboards at least daily, although several firms admitted that daily -- or even weekly -- refreshes of the data were still in the future.

"Our sales dashboard is updated each day to provide daily, monthly, and quarterly sales performance versus projected sales. Right now it's only accessible to executives." (Retailer)

"The base reporting systems are real-time, but the dashboard is updated weekly." (Energy company)

"We are still trying to get the data warehouse organized before rolling out all of the planned dashboards. The data warehouse was developed as part of the dashboard project." (Financial services company)

. . . But Dashboards' Role In Operations Remains Generally Passive

Only two firms sent alerts about threshold variances to individuals designated to take action on the problem the variance represented. And none of the firms linked the dashboard directly to analysis other than to drill down into lower levels of detail.

"Since we only update the dashboard data monthly, we are not using alerts right now. Maybe we will look at them when we begin to update the dashboard more frequently." (Financial services company)

"We use a broadcast agent to send email alerts. Inside the module we set up scheduling so that it runs every day, looking at exceptions, sending an email to certain individuals under prespecified conditions." (Retailer)

"Our scorecard is straightforward -- no what-if functionality. Analysis is a lot of what we do, but it's not integrated yet." (Energy company)

ANALYSIS

**Business Dashboards Must Drive Business Action**

Firms need greater visibility into business operations -- and dashboards are a way to provide it. Today's projects are immature -- passive displays meant for executive eyes only. To deliver real value, dashboards must be connected to processes they measure, linked to analytics, and frequently re-evaluated for relevance.

TODAY'S EXECUTIVE DASHBOARDS ARE A WASTE OF MONEY

Our interviews with pioneering dashboard project owners illustrate the early evolution of the usefulness of this intelligence tool in keeping a business, like a car, on course (see Figure 2). What makes a dashboard different from other business intelligence tools? Dashboards are graphical representations of the difference between a predefined metric threshold and actual performance. But as currently conceived, dashboard initiatives will fizzle out because they are too:

- **Lofty.** The executive mandate for a visual representation of business operations has produced well-publicized dashboards and cockpits for firms like General Electric that created visual tools for management eyes. The problem? Either data was updated less frequently than the pace of business decision-making or top execs were the focal point for notifying those lower in the organization that action was required.

- **Passive.** Only a few interviewees targeted alerts to specific individuals. Most assumed that dashboards exist to help viewers make better decisions and figure out who should be notified. Even well-known projects like America West Airlines' flight operations dashboard portal -- showing on-time takeoffs/arrivals and planned/unplanned maintenance -- do not directly link viewed threshold variances to action.

- **Disconnected.** In addition to being view-only, most dashboards are not designed to integrate with the roles employees play in processes like sales pipeline management. While a top executive at IBM can pinpoint which sales region is below forecast, the necessary steps and implicated constituents required to correct the problem are beyond the domain of the dashboard.

Figure 2 Dashboard Example: Keeping Track Of A Retail Call Center

Retail Call Center Daily Dashboard
November 24, 2003, 4:00 P.M.
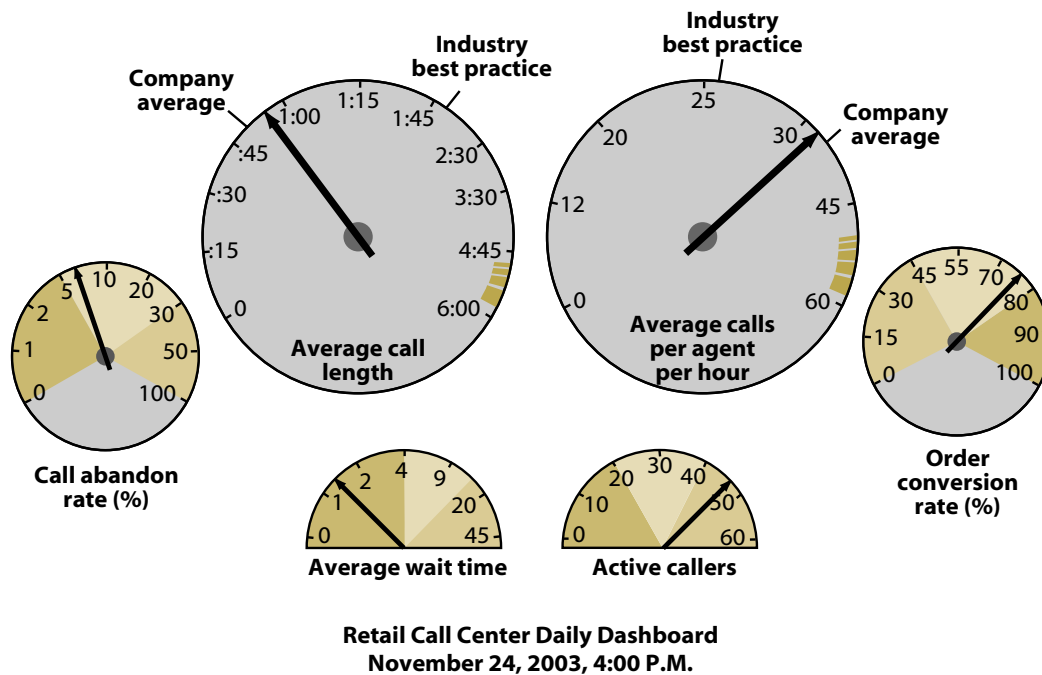
Source: Forrester Research, Inc.

ACTIVE DASHBOARDS HELP MANAGE THE BUSINESS

In the wake of the Enron scandal, large enterprises have been under increasing pressure to prove to themselves and their shareholders that their businesses are well-managed. In addition, tough economic conditions have increased executive attention on monitoring costs and revenue more closely. But putting the word "executive" with "dashboard" constrains the potential, as C-level execs rarely solve organizational problems directly. Instead, we recommend <u>active</u> dashboards that target (see Figure 3):

- **Midlevel management.** The president of America West can do little to alter flight schedules when weather problems create delays. To make a dashboard effective, its metrics should be derived from company strategy set by top management, but project sponsors -- and dashboard metric owners, action-takers, and viewers -- must be at the level of decision-making and accountability appropriate for the metric. So America West's flight operations should sponsor and designate action-takers, even though the dashboard provides summaries to upper management.

Figure 3 Dashboard Projects Should Target The Right Operational Level

Project scenario	Dashboard objective	Link to strategy	Sponsor and owner	Sample metrics	Resulting actions	Further analysis and action
1. Airline	Measure daily flight performance	Grow business customer loyalty	CEO sponsors; director of flight operations owns	Reservations, scheduled flights, daily delays	Operations reroute, reschedule flights	Links to maintenance schedules, plane capacity
2. Wireless telecom	Reduce customer churn	Increase customer retention	VP of sales sponsors; marketing director(s) own	Cancellations of accounts by profitable customers	Call center agents offer service promotion	Compare defection dates with trends in behavior
3. Hard goods	Maximize on-time shipments	Improve customer satisfaction	VP of manufacturing sponsors; plant manager owns	Daily shipments missed per product line	Shop-floor supervisors allocate production	Links to rework levels, scrap, attendance
4. High-tech	Forecast quarterly sales	Grow share in new geographic markets	VPs of sales and marketing sponsor; VP of sales owns	Sales pipeline status and projected trend-line by product line, by region	Regional manager seeks marketing support	Examine historical campaign response times
5. Apparel retail	Manage supply costs	Lower cost of goods	VP of purchasing sponsors and owns	Off-contract buying, contract price to market with history	Business unit executives contact employees	Analyze off-contract buying history

Source: Forrester Research, Inc.

- **Metrics that align with goals.** Most dashboards have too many metrics. Firms should limit themselves to fewer than 20 initial metrics that are important to the business and can be supported with valid data indicators. Dashboard project teams should also regularly review them to see if they continue to be of value. One telecom firm set a metric, "keep customer churn low," only to discover that 75% to 80% of the customers they were trying to keep were unprofitable. The new metric? "Keep churn low among profitable customers."

- **Role-based accountability.** Dashboards that are integrated directly into process workflow roles will trigger process improvements. So firms should design dashboards for processes coupled to compensation of the process owners -- like manufacturing quality/plant managers, customer service/call center managers, or employee retention/store managers. For example, Maysteel created a dashboard

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for manufacturing floor and quality statistics tracking -- with information targeted to individuals who can take action on scrap and rework levels, order status, and customer shipments.[3]

- **Contextual analysis and problem solving.** Dashboards can detect current business pain -- or serve as predictors of "pain to be." As firms refine their dashboards, project owners should correlate metrics with root cause analysis -- such as the relationship between lengthening supplier delivery times and declining shipments to distributors. Inventory management dashboards with contextual analysis can then suggest corrective actions or launch an online problem-solving meeting -- like suggesting a switch to an alternate supplier or reviewing a draft replenishment order for a distributor customer.

MAKING DASHBOARDS ACTIVE

Business execs with a case of dashboard mania must understand that the project has a beginning -- but not an end. Dashboards instead evolve as a series of small victories, each one offering an opportunity to gain insight, refine metrics, and deploy ever more widely to action-takers throughout the enterprise. To get started, firms should follow a three-step cycle that fits within a 90-day timeline (see Figure 4). Then teams should periodically repeat the cycle of steps to analyze the impact, refine metrics, and expand to other parts of the enterprise.

Step 1. Create A View-Only Prototype

The dashboard project should start out as a prototype, presenting a few metrics, validated by a few individuals and dependent on accurate data. The team should:

- **Select the metrics that matter.** The dashboard project should be launched by a line-of-business process owner like a VP of customer service or sales. When deciding on a key metric, teams should ask themselves whether these metrics really link to company strategy (see the May 13, 2003 Forrester Brief "BI Success Requires Metrics Maturity").[4] For example, Dow Corning -- engaged in silicon technology research for nanotechnology, biotech, and photonics -- has created a dashboard of visible KPIs that includes revenue, profit margin, customer satisfaction -- and an "innovation index."

- **Verify definitions with action-takers.** Top execs sometimes pick a metric that is top-of-mind -- but can harm the business. In the mid-1990s, for example, Continental Airlines set out to measure pilots on a metric to "use less fuel," which inadvertently lost business customers because of slowed flight speed, increased delays, and reduced air conditioning.[5] A pilot on the metric team would

Figure 4 Ninety-Day Iterative Cycle To Create And Sustain Active Dashboards

**Step 1: Create a view-only prototype**
• Select the metrics that matter
• Verify definitions with action-takers
• Validate data sources and benchmarks

Step 2: Make prototype actionable
• Add thresholds and action-takers
• Match refresh rates to the
  cycle of decision-making
• Institute review and feedback

Step 3: Analyze and refine
• Revisit thresholds
• Add contextual analysis
• Collaborate on problem-solving

Step 1
Days 1-30

Step 3
Days 30-90

Step 2
Days 15-45
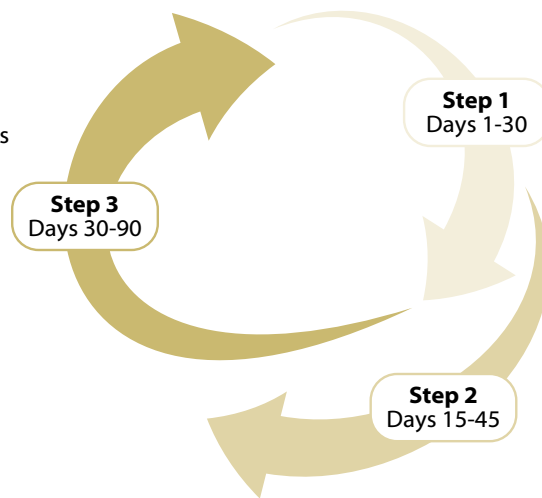
Source: Forrester Research, Inc.

have noted the unintended consequence of selecting that metric -- recommending instead that it be adjusted to "lower costs in ways that don't impact customer service."

• **Validate data sources and benchmarks.** Within the first 30 days, the dashboard project team should serve up a prototype with only a few status metrics displayed, sourced from a cleansed data set. The team should validate it with a handful of viewers who can provide answers to questions like: Are these metrics computed from verifiable data sources? Can the data be updated within the cycle of decision making? Is there standard or benchmark data of good performance that can be compared with these metrics?

Step 2. Make Prototype Actionable

Even as the initial prototype is being reviewed and accepted, the dashboard team should begin the next phase of the project in which they:

• **Add thresholds and action-takers.** In the second 30-day phase, the team sets thresholds -- calculations to compare actual performance with a goal or benchmark. The team should decide who should be alerted if a threshold is exceeded --

identifying an escalation or alternate notification path if primary designates are unavailable. For example, retailers use Lawson's "smart notes" to alert store-floor or distribution-center handhelds that inventory is low or a revenue threshold has been reached.

- **Match refresh rates to the cycle of decision-making.** The dashboard team must ensure that the data update frequency and corresponding changes in the dashboard display match the decision-making cycle time. At ABN AMRO Bank, the IT staff uses Micromuse to alert accountable individuals of network problems, enabling them to avert interruptions to trading systems.

- **Institutionalize dashboard review and feedback.** The best way to keep a dashboard active and grow its usefulness in the enterprise? Early on, make a review of its impact on regular activity, examining potential process improvements, redefinitions of metrics, and alternative action-takers. In the previous Continental Airlines example, the team would have met on a weekly basis to look at fuel-expense metrics and for other changes in business behavior that might relate -- such as customer defections.

Step 3. Analyze And Refine

Once the dashboard is institutionalized and actionable, the team should swing into gear to ensure that it can be made more useful, be more widely deployed, and create visibility into more dimensions of the business. They should:

- **Revisit the thresholds -- is green good?** Within the next 30-day phase, the project team finalizes the metrics and thresholds, focusing on thresholds that always seem to be met to see if they are rigorous enough to achieve other business goals. If a threshold like "50% quote-to-order conversions" makes sense in the Northeast region but not in the poorly penetrated Southwest geography, teams should consider distributing threshold-setting out to individual organizations, setting a higher threshold for green in the Northeast.

- **Add contextual analysis.** With a GPS car navigation system, drivers can discover that the car is running out of gas and use the mapping system to identify nearby gas stations and how to reach them. In the same way, a dashboard can offer correlation between metrics -- such as the relationship between growing customer returns and manufacturing defect rates -- linking them with prior-period history and viewing alternative solutions.

- **Collaborate on problem-solving.** KPI is often a misnomer for displayed metrics that must be interpreted by people to identify indications of future performance. At this point in the project, sponsors must extrapolate the future performance if

current behavior continues. Then they should create shared workspace problem-solving areas or launch online meetings with action-takers to head off problems.

BI TECHNOLOGY IS RIPENING TO HELP BUILD ACTIVE DASHBOARDS

To make dashboards truly effective, vendors and IT traditionalists must let go of preconceived notions and buzzwords that hamper the benefits of dashboards and migrate (see Figure 5):

- **From data repositories to aggregation on the fly.** Verizon used to limit metric access to a handful of executives. Today, the telecom giant offers up hundreds of metrics to several hundred thousand employees and partners through its Verizon.com portal. How? With business Web services built on a Microsoft platform to push, pull, or feed metric information into a portal-based dashboard. Vendors like Iteration Software and CXO Systems grab information directly from transaction systems as well as external unstructured data, do their own aggregation, and present them to users in near real time.

- **From data to process.** As dashboards become active, the dashboard action-taker role will be linked to the workflow for managing processes like customer service escalations, derived from supporting apps like Siebel or PeopleSoft. And dashboard vendors like Lighthammer for manufacturing, Micromuse for IT, and VistaSource for telecom offer dashboards that filter and focus users' attention -- sending a mobile phone text message to the quality manager about growing scrap levels, not bothering top executives who can't take action.

- **From hierarchical access to populist collaboration.** Restricting access to metrics is an artifact of command-and-control companies. The carefully restricted hierarchical dashboard, cascading metric information in increasingly restricted sets to lower levels of the organization, is increasingly obsolete. So vendors from Spotfire to Computer Associates offer the ability to exploit collaboration capabilities like annotation, instant messaging, and shared workspaces.

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Figure 5 The Technology Is Changing To Enable Active Dashboards

Traditional approaches hold back users	What active dashboards need	Emerging technologies	Sample vendors to consider
Static Periodic updates to data warehouse and data marts	**Dynamic** • Data pushed as changes occur • Pulled directly from structured and unstructured sources • Internal and external	• Web services • Memory-based analysis caches • Message-based streaming from real-time data	• CXO Systems • ProClarity • Iteration Software
Data-oriented User roles linked to subsets of data	**Process-oriented** Workflow configured with designated roles at specific process steps	• Role-based workflow • Industry domain-specific processes	• Lighthammer • VistaSource • Micromuse • PeopleSoft
Hierarchical Access restrictions based on organizational level	**Populist** Transparency and collaboration created across process participants	• Office product integration • Instant messaging • Online meetings	• Spotfire • Computer Associates • Microsoft • IBM

Source: Forrester Research, Inc.

A C T I O N

✓ **Don't settle for data just because it's in the warehouse.**
It's a fact: Dashboard project teams must incorporate IT data experts to identify
both where -- and how good -- the source data is. But teams should be wary
of the trap of selecting metrics just because they are easy to access from a static
data warehouse (see Figure 6). Instead, dashboard teams should focus IT resources
on crafting short- and longer-term ways to obtain up-to-date information that is
critical to metric calculations -- like grabbing delayed orders directly from J.D.
Edwards rather than waiting for the weekly update of the corporate data
warehouse.

✓ **Use dashboard reviews as catalysts for process redesign.**
If a dashboard is effective, organizations will become dependent on its existence.
And regular dashboard reviews will ensure that metrics are still valid -- and also
identify processes that need fixing. For example, if an on-time shipments dashboard
at Toshiba regularly alerts supervisors of replacement parts shortfalls, the
dashboard review team can serve as a squeaky wheel for an overhaul of the
component supply replenishment process.

✓ **Expect even the new dashboard software to use three tiers.**
From an IT architectural standpoint, there is no "dashboard free lunch." All
dashboard implementations, whether homegrown, purchased through new
vendors like CXO Systems, or from BI stalwarts like Cognos, involve three
software layers: an information delivery layer that produces and displays the
dashboard visuals; a business rules layer that stores the data, workflow, and
metric definitions; and a data sourcing layer that extracts and transforms the
data from wherever it is sourced.[8]

✓ **Search for those nonobvious leading indicators.**
Too often firms fixate on lagging indicators of performance -- like the total
numbers of customer service calls in the past month -- as indicators of future
activity. But as active dashboards evolve over time, firms should search for
correlations with the nonobvious. A customer service example: The installed
customer base of 2001 Ford Rangers nears expiration of their warranties which
should serve as a leading indicator for future service center staffing requirements.
The dashboard should prominently display this potential future peak in demand
and suggest a marketing campaign offering service discounts.

Figure 6 Metric Availability Does Not Imply Operational Value

Airline customer service metrics
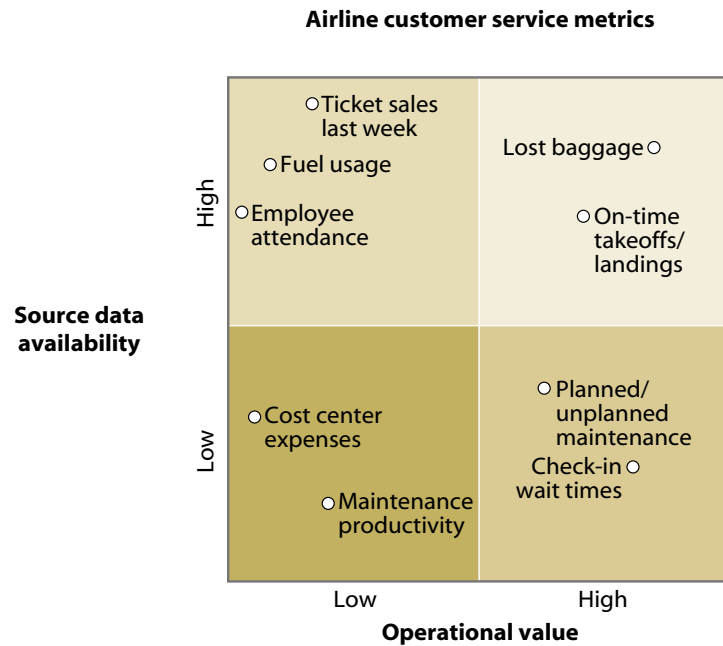
Source: Forrester Research, Inc.

W H A T   I T   M E A N S

(!) ### BI vendors have all the data trees but not the portal forest.

The vertically integrated business intelligence vendors like Cognos and Hyperion are comfortable selling to their primary constituency, IT and business data analysts. But as dashboard implementations mature and are presented to organizations within the portal environments managed by IBM, Microsoft, or SAP, dashboard owners will rightly ask why they're running two completely separate infrastructures. BI vendors will find themselves acting as a services layer, expected to expose information in a portlet-consumable and standards-based format for portals that span content, collaboration, and workflow.

(!) ### Consultants will compete to bridge strategy and operations gap.

Strategy consulting firms have capitalized on the performance management bandwagon, offering methodology guidance that ranges from yesteryear's balanced scorecard to today's trendier corporate (or enterprise) performance management. As dashboards become more active at the midmanagement level of the organization, strategy firms like McKinsey and Bain will bump heads with Deloitte Touche Tohmatsu and IBM's Business Consulting Services to provide a full range of dashboard methodologies that span boardroom to manufacturing clean room.

(!) ### Enterprises will look to dot-com teams for active examples.

Active dashboards, widely deployed, are already standard practice for the Web-centric side of many firms in industries like retail, financial services, travel, and consumer goods manufacturing. Business unit and functional executives may be surprised to find examples that they can poach from eCommerce veterans that alert action-takers of inventory shortfalls or unexpected spikes in customer complaints.

(!) ### Industry consortia will provide dashboard benchmark data.

The Institute for Supply Management, CAPS Logistics, and other industry groups like UCCNet will increasingly define industry metrics and deliver the external benchmark data to dashboards. Firms wondering if their own purchase prices, lead times, or shipping costs are competitive will pressure these consortia to offer subscriptions to consolidated data sets -- like Information Resources for consumer retail -- that can be used to make dashboards more active in tuning business processes.

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Related Research

May 13, 2003 Forrester Brief "BI Success Requires Metrics Maturity"

December 2002 Forrester Report "Use Business Intelligence To Manage Velocity"

September 2002 Forrester Report "Managing Business Velocity At The Edge"

GRAPEVINE

Dashboard duct tape -- but is it sticky?
We spoke with Rick Bullotta, CTO of Lighthammer, a dashboard vendor that has partnered with SAP to produce a dashboard built on manufacturing information. Lighthammer's goal? Interfacing with the masses -- or as he quotes Deming: "You can't improve what you can't see." His view is that balanced scorecards, BAM, and other methodologies come duct-taped to consultants who show up to teach firms the right way to do the project. But it's all for naught if firms buy technology and consulting -- and don't invest in change management and training of employees on how the dashboard will actively alter their jobs.

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Drivers move from passive automotive dashboards to contextual guides.
David Butler of Spotfire probed the car dashboard analogy, pointing out that: "A car navigation system adds an interactive element, helping the driver get to a specific destination. By creating an environment for the driver to interact with -- selecting the route or landmark -- a car owner can create repeatability, enabling retracing of a route on another day. Without that context, there is no way to verify if the turns along the route you are driving will actually get you to the destination." In the same way, business operations dashboards need to be placed into the context of an organizational goal and offer validation en route that activities are on a good path -- or need redirection.

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Not a Y2K project.
Citing their own experience with a dashboard project at CA, John Ulery and George Watt suggested a series of questions to trigger thinking among dashboard project teams: "When an event occurs, is it actionable? Is it linked to source applications -- creating a transaction, for example? Can someone be contacted? Is it recorded that I did something? Can I create a historic base to use technologies like pattern matching or clustering? What about predictive technologies? Where can rules be applied? You can't do these things on day one of a project. It's not a Y2K effort, where you're done when the clock turns into the next century. There's no end to this project." Amen.

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E N D N O T E S

1   We developed and launched survey questions in August 2003 as part of a client consulting engagement. The client did not select the companies we interviewed, nor did it have any influence over the assessment and analysis of the responses. Further, it was understood by both the client and survey participants at the time of the engagement that the surveyed results would be applied to the creation of this published research.

2   Dashboards are graphic summarizations, typically in dial form, of metrics that have been compared with predetermined thresholds. Dials are often colored green for acceptable performance, yellow to warn of a delta between metric and actual result, and red when the actual numbers vary notably.

3   IBM WebSphere Business Integrator, Savvion BusinessManager, or Microsoft BizTalk Server can all help with role-based business process integration.

4   Firms need to evolve metrics from local focus to enterprise-level, adding alerts and actions along the way.

5   When selecting metrics, executives need to streamline and simplify metrics that are aligned with the correct data, avoiding the trap of selecting metrics purely to match Wall Street expectations. Source: Michael Sisk, "Are the Wrong Metrics Driving Your Strategy?" *Harvard Management Update*, November 2003.

6   Source: Keith Gile, "Market Overview 2003: Business Intelligence And Redefining the Analytic End User," Giga Research, April 21, 2003. BI market growth in the next 24 to 36 months will be driven by the ability of vendors to redesign their core technology to satisfy the needs of business users, rather than power users. To learn more about Giga or to obtain Giga's research, email: learnmore@forrester.com.

7   Source: Daniel W. Rasmus and Keith Gile, "Taking Action: Business Intelligence and Collaboration," Giga Research, July 21, 2003. Business intelligence vendors need to start integrating collaboration into their technologies, but not necessarily creating their own collaboration technology. To learn more about Giga or to obtain Giga's research, email: learnmore@forrester.com.

8   Source: Keith Gile, "The Three Key Components of an Active Dashboard," Giga Research, December 2003. Lacking any of the component layers will invite significant customization of the dashboard, driving costs up significantly. To learn more about Giga or to obtain Giga's research, email: learnmore@forrester.com.

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Retail
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